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properties of each of these are considered at some length and the evidence pointing to the identity of the alpha particles with charged helium atoms is clearly presented.

The second chapter is devoted to the radioactive constants and periods of average life of the radio-elements. Here, as elsewhere in the pages which follow, Mr. Soddy has shown a preference for denoting the relative stabilities of the different radio-elements by their so-called "average life" periods rather than by their "half-value" periods adopted and used by nearly (if not quite) all the other writers on the subject. To the reviewer the "average life" of a radio-element is merely the reciprocal of the constant of radioactive change, an occasionally convenient mathematical expression having little or no objective significance. Mr. Soddy defines it as "the sum of the separate periods of future existence of all the individual atoms divided by the number in existence at the starting point." The "half-value" period, on the other hand, is the time required for exactly one half of any given quantity of a radioactive substance to disintegrate or be transformed into other types of matter.

A very interesting and suggestive section on radioactive equilibrium completes the second chapter.

The title of the third chapter is the "Classification and Nomenclature of the Radio-elements.—Analogies Between the Three Disintegration Series," but the subjects covered are much more comprehensive than this heading would imply and include many topics of extreme interest and importance. In the opinion of the reviewer this chapter is the most valuable and illuminating portion of the entire book and the one to be most profitably extended and developed in future editions. It contains the essence of a new branch of science, radiochemistry, and Mr. Soddy has succeeded in collecting together and presenting in a relatively small space, and in a very impressive and convincing manner, much that has previously been accessible only in scattered scientific publications of his own and of other workers in this field of scientific in-

quiry. Thus, for example, the conditions determining the possibility of separating and isolating any given radio-element in a state of comparative purity are briefly but comprehensively considered, the general methods of obtaining the so-called "active deposits"—the solid radioactive products resulting from the disintegration of the gaseous emanations—are outlined, and the inferences to be drawn as to the true chemical nature of the different radio-elements from a knowledge of the behavior of these when mixed with large proportions of their apparent chemical analogues are discussed in some detail.

This general introductory matter occupies in all only thirty pages and one can not avoid a feeling of regret that it was not found practical to extend it still further. It is followed by a systematic presentation of the more important physical and chemical properties of the thirty-odd radio-elements thus far identified arranged in an orderly fashion under the separate headings, "Uranium," "Uranium X," "Ionium," "Radium," etc.

Mr. Soddy has provided us with a very valuable book of its kind, unique in respect to the field which it covers. It need scarcely be added that no one who desires to work intelligently in this modern branch of chemistry can well afford to be without it.

B. B. BOLTWOOD

*Stability in Aviation: an Introduction to Dynamical Stability as Applied to the Motion of Aeroplanes.* By Professor G. H. BRYAN, Sc.D., F.R.S. Macmillan and Co. 1911. Pp. xi + 192. Price, \$2.00.

Any one seriously at work on the theory or the art of aviation would profit by reading what he can of this book, though precious few will have both the time and the ability wholly to master it and probably none, not even the author of it himself, fully to solve all the difficult problems it sets.

The first chapter gives, in 18 pages of concise non-mathematical language, a summary of existing knowledge on aeroplane stability, and incidentally forms a good mental appetizer for the very solid intellectual courses that fol-

low. But the busy man and the man without mathematical training must take the statements of the next 8 chapters, or 146 pages, on faith. The essential equations in the greatest abundance are there and their meanings explained, but checking them all up would be no easy task.

The general conclusions all this mathematical work leads to are given in a short chapter of only 6 pages, and in another place 20 separate theses are proposed that should set many young men at work on problems that are both new and useful in applied mathematics.

But, the "practical" man will say, what's the use of all this theory and all these mathematical equations? The answer in this case as in all similar cases is: To tell the practical man what to practise, what experiments are needed and what are not, what general type of machine is likely to succeed and what is certain to fail; to save him from needless blundering and to assure him of results and how to obtain them that he never did and never would even dream of.

Professor Bryan's book is especially adapted to the needs of advanced students in physics, applied mathematics and certain branches of engineering, and richly deserves a place in both mathematical and physical libraries.

W. J. HUMPHREYS

*Non-Marine Mollusca of Patagonia.* By HENRY A. PILSBRY. Reports Princeton University Expeditions to Patagonia, Vol. III., Part V.

This important work was issued in 1911, but there is nothing about the separate issue to indicate the date. It deals with the non-marine molluscs of Tierra del Fuego and Patagonia as far north as the thirty-ninth parallel, and is most beautifully illustrated by colored and uncolored plates. Of certain families, all the South American forms are listed. At the end is given a most interesting discussion of the characteristics and origin of the South American Mollusca.

The poverty of the Patagonian fauna in land snails is remarkable. Seven Endodon-

tidæ and the two Zonitidæ have been described, all small. Their precise affinities are uncertain, from lack of knowledge of the internal anatomy. A small slug has been reported, perhaps introduced. *Succinea* is represented by several species, one of them abundant. No doubt other species will be discovered, but certainly no other part of the world, in a similar latitude, has such a meager representation of land shells. With the fresh-water snails it is somewhat different, the fauna not only containing a number of species of the families familiar in the northern hemisphere, but also a rich representation of the Chilidæ, a family confined to the temperate and cold zones of South America. All the Chilids east of the Andes are discussed, with four fine plates. Six colored plates are devoted to the Amnicolid genus *Potamolithus*, of which a complete revision is given. There is a complete list of the South American Sphæriidæ, with descriptions of several species. Thus the work, while ostensibly a report on the Princeton collections, is in reality much more extensive and important than the title would suggest.

All zoologists will be interested in the general discussion of the fauna. Dr. Pilsbry recognizes a Cœnogæic or northern group of families, and an Eogæic or southern group, the latter having "occupied chiefly the Gondwana continent, including a large part of South America, tropical and South Africa, and stretching in a great arch, possibly at no time perfect, to peninsular India and Australia." It is in this second group that he would place the Mutelidæ, Ampullariidæ, Acavidæ, Bulimulidæ, Achatinidæ, Strep-taxidæ, etc. With regard to Antarctica, it is shown that the non-marine molluscs, taken by themselves, indicate that: (1) "There is no evidence that Antarctica was ever an evolution or radiation center for non-marine mollusks, though there is some evidence showing that it served as a highway for migration." (2) "There is some evidence of migration from South America to Australia, but at present no evidence of a counter movement to South America." (3) "Nothing in the dis-